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The Myth of Phosphate Fertilizer:

"Phosphate fertilizers will stimulate root growth of transplanted trees and shrubs"

This commonly spread myth originates from the legitimate addition of phosphorus to agricultural fields. Phosphorus is one of the inorganic macronutrients needed by all plants for the manufacture of phosphate-containing nucleic acids, ATP and membrane lipids. Soils that have been heavily used for agricultural crops are often deficient in phosphorus, as are acid sandy and granitic soils. In landscaped urban soils, however, phosphorus is rarely deficient and the misapplication of this element can have serious repercussions on the plant, the soil environment, and adjoining watersheds.

When an element is limiting in the soil, plant growth slows. This phenomenon is called environmental dormancy. When the deficient element is added, the environmental constraint is lifted and plant growth resumes at the normal rate if nothing else is limiting. Somehow the observation of growth *restoration* was interpreted as growth *stimulation* (i.e. a growth rate greater than normal) and hence fertilizers are often regarded as miraculous compounds (just look at the names of some of them!).

One of the classic symptoms of phosphorus deficiency is reddening of the leaves. Unfortunately, many environmental stresses also induce foliar reddening; examples include cold temperature, high light intensity, insect damage, and drought. Urban landscape plants are much more likely to experience one of these stresses than phosphate deficiency.

In contrast to phosphorus, nitrogen is much more likely to be limiting in urban landscapes. Nitrogen deficiency is characterized by overall leaf chlorosis. Among other things, the lack of nitrogen reduces the plant's ability to take up phosphorus. When nitrogen is restored to optimal levels, the plant's ability to scavenge phosphorus from the soil is markedly improved. It's important to realize that when nitrogen is deficient it does not logically follow that other nutrients must be deficient as well.

Because nitrogen is so often deficient in an actively growing landscape, the addition of ammonium nitrate usually restores shoot growth. Phosphate addition, on the other hand, often has no apparent effect (probably because it's generally not limiting in perennial landscapes. This observation has led landscapers and fertilizer manufacturers to claim that phosphorus stimulates root growth (there is no shoot growth, ergo it must be stimulating root growth). The unfortunate result of these assumptions is the mantra "nitrogen for shoots and phosphorus for roots." While there are no nitrogen toxicity symptoms *per se*, the same cannot be said for phosphate toxicity.

The result of phosphate overfertilizing is leaf chlorosis. Phosphorus is known to compete with iron and manganese uptake by roots, and deficiencies of these two metal micronutrients causes interveinal yellowing. It's my belief that many of the chlorotic shrubs we see in urban landscapes are suffering *indirect* iron (or manganese) deficiency from overapplication of phosphorus. Moreover, it has been experimentally demonstrated that high levels of phosphorus are detrimental to mycorrhizal health and lower the rate of mycorrhizal infection of root systems. This mutually beneficial relationship between the fungus and the plant roots allows the plant to more effectively explore the soil environment and extract needed nutrients. In the absence of mycorrhizae, the plant must expend more energy growing additional roots and root hairs to accomplish the same task.

In addition to harming beneficial soil organisms, excess phosphate will eventually find its way into waterways. Unlike urban landscapes, aquatic plants are most often limited by phosphate and the addition of phosphate will induce algal blooms (eutrophication). Such blooms are always followed by increased

bacterial activity, resulting in lowered oxygen levels and the eventual death of fish and other animals. As green industry professionals, it is incumbent upon us to recognize that excessive use of phosphorus in landscapes is a resource-wasteful, ecosystem-damaging practice.

Bottom line:

- Maintain organic material (mulch) on landscapes; this provides a slow release of phosphorus and other needed macro- and micronutrients over time.
- Don't use phosphate fertilizer when transplanting; in most cases ammonium nitrate fertilizer is adequate.
- If you have a nutrient deficiency that is not relieved by nitrogen addition, try a foliar application of likely nutrients and see if the symptoms are alleviated. This prevents excessive addition of mineral nutrients to the soil.

For more information, please visit Dr. Chalker-Scott's web page at http://www.theinformedgardener.com.